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(54) **CONSTANT-CURRENT DEVICE, DISPLAY DEVICE, AND METHOD FOR DRIVING THE SAME**

(57) An object of the invention is to suppress a delay in rising of drive voltage when a light-emitting element to be a capacitive load is driven while preventing an increase in circuit size. A display apparatus comprises: an organic EL display (1) including organic EL elements as light-emitting elements; a scanning electrode drive circuit (2) for driving scanning electrodes of the display (1); and a data electrode drive section (3) for driving data electrodes of the display (1). The data electrode drive section (3) includes constant current circuits for the respective data electrodes, each of the constant current circuits supplying a constant current to each of the data electrodes. Each of the constant current circuits allows the value of constant current outputted to change in response to the reference value given such as a reference voltage. The reference value is switched such that, with regard to the period for which one of the scanning electrodes is selected, the value of the constant current supplied to one of the organic EL elements for a specific period started at the point at which the current starts to be supplied is greater than the value of the constant current supplied to the EL element for the remaining period.

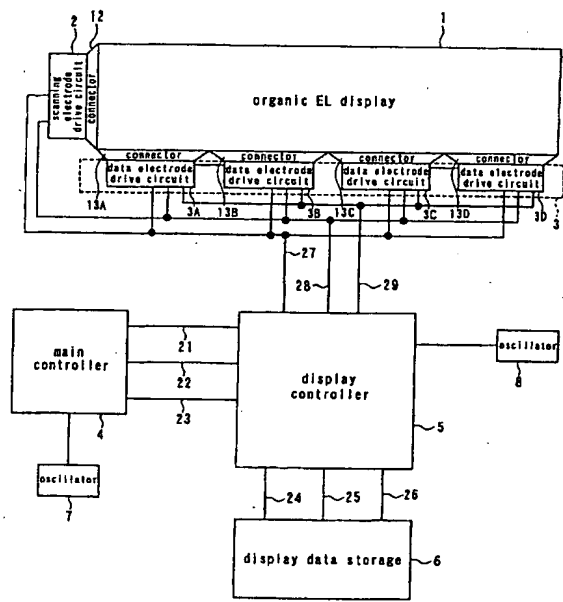


FIG. 1

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lowing description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

FIG. 1 is a block diagram illustrating an example of the entire configuration of a display apparatus of an embodiment of the invention.

FIG. 2 is a schematic circuit diagram illustrating the configuration of the organic EL display, the scanning electrode drive circuit and the data electrode drive section of FIG. 1.

FIG. 3 is a circuit diagram showing the main part of FIG. 2.

FIG. 4 is a circuit diagram that illustrates an example of configuration of the constant current circuit of FIG. 3 and its peripheral circuitry.

FIG. 5 is a circuit diagram that illustrates an example of a reference value generating circuit of the embodiment of the invention.

FIG. 6 is a circuit diagram that illustrates another example of the reference value generating circuit of the embodiment of the invention.

FIG. 7 is a circuit diagram that illustrates the main part of the constant current circuit when the reference value generating circuit of FIG. 6 is utilized.

FIG. 8 is a circuit diagram that illustrates still another example of the reference-value generating circuit of the embodiment.

FIG. 9 is a circuit diagram that illustrates still another example of the reference value generating circuit of the embodiment.

FIG. 10 is a circuit diagram that illustrates the main part of the constant current circuit when the reference value generating circuit of FIG. 8 or 9 is utilized.

FIG. 11 is a circuit diagram that illustrates still another example of the reference value generating circuit of the embodiment.

FIG. 12 is a circuit diagram that illustrates still another example of the reference value generating circuit of the embodiment.

FIG. 13 is an explanatory view for describing an example of configuration of the organic EL display of the embodiment.

FIG. 14 illustrates the waveform of current supplied to the organic EL element and the waveform of voltage across the organic EL element, according to the embodiment.

FIG. 15 illustrates the waveform of current supplied to the capacitive load from the constant current source, and the waveform of voltage across the capacitive load.

BEST MODE FOR CARRYING OUT THE INVENTION

[0030] An embodiment of the invention will now be de-

scribed in detail with reference to the accompanying drawings.

[0031] FIG. 1 is a block diagram illustrating an example of the entire configuration of a display apparatus of the embodiment of the invention. The display apparatus of the embodiment comprises an organic EL display 1 incorporating: scanning electrodes and data electrodes that are arranged in a matrix; and a plurality of organic EL elements that function as light-emitting elements connected to the respective scanning electrodes and data electrodes, each of the organic EL elements being located at the intersection of each of the scanning electrodes and each of the data electrodes. Each of the EL elements illuminates when a specific voltage is applied across the element by each of the scanning electrodes and each of the data electrodes. The organic EL display 1 corresponds to the display of the invention.

[0032] The display apparatus of the embodiment further comprises: a scanning electrode drive circuit 2 for driving the scanning electrodes of the display 1; a data electrode drive section 3 for driving the data electrodes of the display 1; a main controller 4 for outputting data to be displayed at the display 1 and data relating to display; a display controller 5 for controlling the timing of display at the display 1 and the display size and so on in response to the display data obtained from the main controller 4. The display apparatus further comprises: a display data storage 6 connected to the display controller 5 and provided for retaining the display data obtained from the main controller 4; an oscillator 7 for generating a clock to be used at the main controller 4 and supplying this clock thereto; and an oscillator 8 for generating a clock to be used at the display controller 5 and supplying this clock thereto. The scanning electrode drive circuit 2 and the data electrode drive section 3 correspond to the drive means of the invention that selectively supplies power required for light emission to the EL elements. The display controller 5 corresponds to the control means of the invention.

[0033] The scanning electrode drive circuit 2 is connected to the scanning electrodes of the display 1 through a connector 12. In this embodiment a plurality of data electrodes are divided into four groups. The data electrode drive section 3 includes four data electrode drive circuits 3A to 3D for driving the data electrodes of the respective groups. The drive circuits 3A to 3D are connected to the data electrodes of the respective groups through connectors 13A to 13D. The connectors 12 and 13A to 13D may be heat seal connectors or flexible substrates, for example.

[0034] The main controller 4 is connected to the display controller 5 through a control bus 21, a data bus 22 and an address bus 23. The display controller 5 is connected to the display data storage 6 through a control bus 24, a data bus 25 and an address bus 26.

[0035] The display controller 5 is connected to the drive circuits 2 and 3A to 3D through a signal line 27 for sending a latch pulse from the display controller 5 to the

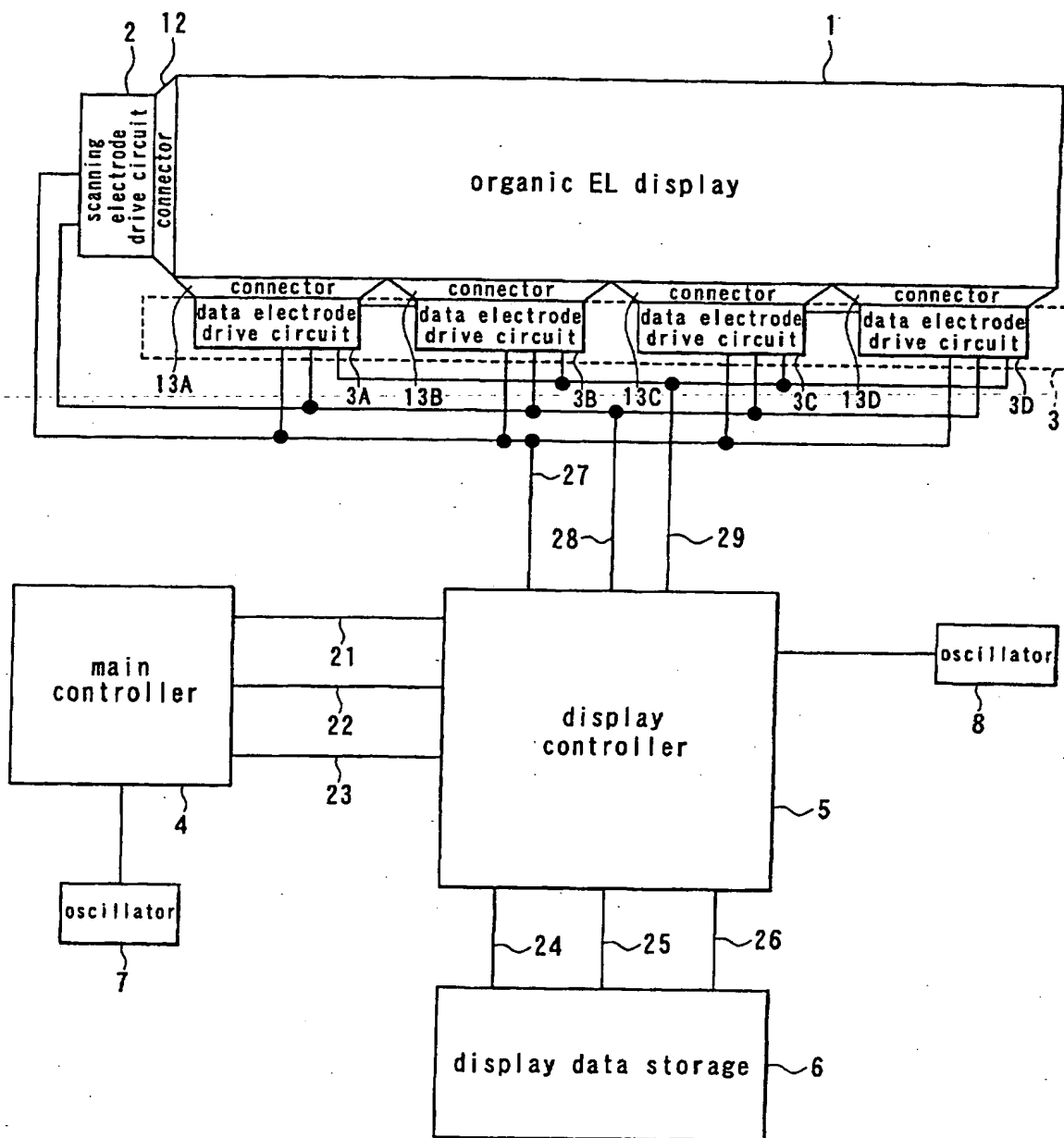


FIG. 1

THE STATE INTELLECTUAL PROPERTY OFFICE OF CHINA

Address: Receiving Department of The State Intellectual Property Office (SIPO)
6 Xitucheng Road, Haidian, Beijing Postal Code: 100088

Applicant	LG.Philips LCD Co., Ltd.	Date of Issue: December 30, 2005
Patent Agent	Beijing Sanyou Intellectual Property Agency Ltd.	
Filing No. of Patent Appln.	200310103281.5	
Title of Invention	Data Driving Apparatus and Method of Driving an Organic Electro Luminescence Display Panel	

FIRST NOTIFICATION OF OFFICE ACTION

1. ☒ The examiner has made the examination on the above cited patent application in accordance with the provision in paragraph 1, Article 35 of the PRC Patent Law.
☐ The SIPO uses its own discretion to make a substantive examination for the above cited patent application in accordance the provision in paragraph 2, Article 35 of the Chinese Patent Law.

2. ☒ The applicant designated the filing date of
Nov. 5, 2002 in the Patent Office of KR as the priority date;
_____ in the Patent Office of _____ as the priority date;
_____ in the Patent Office of _____ as the priority date;
_____ in the Patent Office of _____ as the priority date;
_____ in the Patent Office of _____ as the priority date;
☒ the certified copy of Priority Document(s) has (have) been submitted.
☐ no certified copy of priority document has been submitted heretofore and, according to the provision of Article 30 of the PRC Patent Law, it is deemed that no priority right has been requested.

3. ☐ The applicant submitted the amended text on _____ and _____, after examination, in which
☐ the _____ of the amended text submitted on _____ is unacceptable;
☐ the _____ of the amended text submitted on _____ is unacceptable;
the reason being that the above cited amendment
☐ is not in conformity with the provision of Article 33 of the PRC Patent Law;
☐ is not in conformity with the provision of Rule 51 of the Implementing Regulations of the Chinese Patent Law.
The amendment is not accepted based on the reason in details shown in the attachment sheet .

4. ☒ Examination is made based on the original filing documents.
☐ Examination is made based on the following documents:
Description page(s) _____ of the original filing documents submitted on the filing date
Page(s) _____ on _____, pages _____ on _____
Claims page(s) _____ of original filing documents submitted on the filing date
Page(s) _____ on _____, pages _____ on _____
Drawings page(s) _____ of original filing documents submitted on the filing date
Page(s) _____ on _____, pages _____ on _____
Abstract ☐ submitted on the filing date ☐ submitted on _____
Drawing of abstract ☐ submitted on the filing date ☐ submitted on _____

5. ☐ The notification is made without conducting the search for the patentability.
☒ The notification is made under the search for the patentability.
☒ The following references have been cited in this notification (their serial numbers will be

referred to in the following procedure):

Serial Number	Number or Title of Reference Material	Publication Date (or Filing Date of A Conflict Patent Application)
1	EP1164565	Dec. 19, 2001
2	US2002005825	Jan. 17, 2002
3	CN1361510	July 31, 2002
4		

6. The conclusion of the examination:

☐ In regard to the description:

- ☐ The subject matter of the present application is not accepted based on the Article 5 of the Chinese Patent Law.
- ☐ The description is not in conformity with the provision of paragraph 3, Article 26 of Chinese Patent Law.
- ☐ The presentation of the description is not in conformity with the provision of Rule 18 of the Implementing Regulations of the Chinese Patent Law.

☒ In regard to the Claims:

- ☒ Claims 1,2 can not be allowed owing to lack of novelty based on the provision of paragraph 2, Article 22 of Chinese Patent Law.
- ☒ Claims 3,4,5 can not be allowed owing to lack of inventiveness based on the provision of paragraph 3, Article 22 of Chinese Patent Law.
- ☐ Claims _____ cannot be allowed owing to lack of practical applicability based on the provision of paragraph 4, Article 22 of Chinese Patent Law.
- ☐ Claims _____ can not be allowed because they fall in the scope of the unpatentable subject matters provided by Article 25 of the Chinese Patent Law.
- ☐ Claims _____ cannot be allowed because they are not in conformity with the provision of paragraph 4, Article 26 of Chinese Patent Law.
- ☐ Claims _____ cannot be allowed based on the provision of paragraph 1, Article 31 of Chinese Patent Law.
- ☐ Claims _____ cannot be allowed based on the provision of Article 33 of Chinese Patent Law.
- ☐ Claims _____ cannot be allowed based on the provision of paragraph 1, Rule 13 of the Implementing Regulations of the Chinese Patent Law.
- ☐ Claims _____ can not be allowed because they claim an invention(s) that does not belong to the invention defined by the provision of paragraph 1, Rule 2 of the Implementing Regulations of the Chinese Patent Law.
- ☒ Claims 25-33 cannot be allowed based on the provision of Rules 20 of the Implementing Regulations of the Chinese Patent Law.
- ☐ Claims _____ cannot be allowed based on the provision of Rules 21 of the Implementing Regulations of the Chinese Patent Law.
- ☐ Claims _____ cannot be allowed based on the provision of Rules 22 of the Implementing Regulations of the Chinese Patent Law.
- ☐ Claims _____ cannot be allowed based on the provision of Rules 23 of the Implementing Regulations of the Chinese Patent Law.

The explanation of the conclusion is given in the attachment sheet in details

7. According to the above conclusion, the examiner holds that

- ☐ the applicant should amend the application documents based on the requirement specified in the Attachment Sheet.
- ☒ the applicant should state the reason on which the application can be accepted and amend the part that is indicated not to be in conformity with the requirement, otherwise the application will be rejected.
- ☐ No subject matter in the application is patentable, the said application will be rejected if the applicant does not make a statement or the statement is not convincing.
- ☐ _____

8. The applicant's attention is drawn to the fact that

- (1) in accordance with the provision of Article 37 of the Chinese Patent Law, the applicant shall submit the observations within FOUR months from the date of receiving this notification. If the applicant, without any justified reason, fails to reply within the time limit, the application shall be deemed to have been withdrawn.
- (2) the amendment that the applicant makes shall be in conformity with the provision of Article 33 of the Chinese Patent Law. The amended text shall be furnished in duplicate. The formality of the amendment should be in conformity with the relative provisions of the Guidebook for Examination.
- (3) any response and/or amended specification must be furnished by mail or by hand to the Receiving Department of the Chinese Patent Office. Any documents that are not furnished to the Receiving Department do not have legal effect.
- (4) the applicant and/or his attorney should not go to the PRC Patent Office to meet the examiner if no appointment is made.

9. The text of the notification embraces 3 page(s), along with the enclosures herein:
☒ 3 copies of the cited references are enclosed in pages of 10.
